Memetic Search for Identifying Critical Nodes in Sparse Graphs

Titre	Memetic Search for Identifying Critical Nodes in Sparse Graphs
Type de publication	Article de revue
Auteur	Zhou, Yangming [1], Hao, Jin-Kao [2], Glover, Fred [3]
Editeur	Institute of Electrical and Electronics Engineers
Type	Article scientifique dans une revue à comité de lecture
Année	2019
Langue	Anglais
Date	Octobre 2019
Numéro	10
Pagination	3699-3712
Volume	49
Titre de la revue	IEEE Transactions on Cybernetics
ISSN	2168-2267
Mots-clés	complex networks [4], critical node problems (CNPs) [5], Heuristics [6], Memetic search [7], sparse graph [8]
Résumé en anglais	Critical node problems involve finding a set of critical nodes from a graph whose removal results in optimizing a pre-defined measure over the residual graph. As useful models for a variety of practical applications, these problems are computational challenging. In this paper, we study the classic Critical Node Problem (CNP) and introduce an effective memetic algorithm for solving CNP. The proposed algorithm combines a double backbone-based crossover operator (to generate promising offspring solutions), a component-based neighborhood search procedure (to find high-quality local optima) and a rank-based pool updating strategy (to guarantee a healthy population). Extensive evaluations on 42 synthetic and real-world benchmark instances show that the proposed algorithm discovers 24 new upper bounds and matches 15 previous best-known bounds. We also demonstrate the relevance of our algorithm for effectively solving a variant of the classic CNP, called the Cardinality-Constrained Critical Node Problem (CC-CNP). Finally, we investigate the usefulness of each key algorithmic component.
URL de la notice	http://okina.univ-angers.fr/publications/ua20335 [9]
DOI	10.1109/TCYB.2018.2848116 [10]
Lien vers le document	https://ieeexplore.ieee.org/document/8403891 [11]
Titre abrégé	IEEE Trans. Cybern.

Liens

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